THE INFLUENCE OF IMMEDIATE AND DELAYED INFORMATION ON HUMAN MAZE LEARNING AND TRANSFER

By

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CHAPTER I

INTRODUCTION

Problem

The purpose of this investigation is to determine the relative influence of immediate and delayed information, as a form of guidance, and of different amounts of the same on human stylus maze learning and transfer.

One may well wonder as to the need of such an investigation since the literature is well supplied with studies of the influence of guidance or information upon learning (1, 3, 4, 6, 7, 11, 12, 13, 14, 21, 22, 24, 25, 26, 27). However, these studies are primarily descriptive rather than analytic and explanatory. They yield some generalizations concerning the effect of guidance upon learning, but offer few suggestions for explaining this effect.

This investigation arose primarily from the findings of Aronov's (2) study. He used red and green signal lights to give "consistent" or "inconsistent" guidance, in the form of information concerning the correctness of the turn made, to his subjects as they learned a maze habit. He found that those subjects who received "consistent" guidance tended to become dependent upon the light cues in following the pathway of the maze, while those who received "inconsistent" guidance tended to respond to these cues in one of three fashions: they ignored the lights, vacillated in following

and rejecting the lights, or passively followed the lights. Certain questions arise in view of these findings. What is the effect of such dependency on learning? How or when does guidance facilitate learning? Since some subjects chose to ignore the light cues, may it be that the cues hindered the learning of the essential cues, namely, the tactual-kinesthetic cues at each choice-point in the maze? Others (14, 22) have reported subject dependency upon cues unessential to the development of the required maze habit. If this interpretation is correct then evidence of the detrimental influence might be expected in a transfer task.

Information given at critical times in learning may bring to light the causal relationship between the giving of guidance and the learning process. This study was designed in an attempt to seek out the principles that might suggest explanations for the generalizations found in the literature.

Related Literature

The literature yields the generalization that large amounts of guidance are detrimental to learning. Using manual guidance, Waters (25) showed that, including the guided trials in the number required to reach a criterion, the larger the amount of guidance the poorer the record when compared with a control group. On the basis of savings score the control group was found superior to the experimental group in subsequent maze learning. Koch (11) also found that the efficacy of mechanical guidance was a function of

the amount given. She reports that guidance begun in the early trials of learning shows increased effectiveness up to an optimum amount, after which, guided trials become increasingly less beneficial. She suggests that, "The optimum amount of guidance is probably that which permits a fairly clearly defined habit to develop, but terminates when the habit is still sufficiently plastic to allow a ready substitution of new cues as stimuli for the proper responses." Somewhat contrary to these findings, Maier and Klee (15) found that guidance had very little value for learning since it operated primarily "in breaking old habits." In spite of the supporting and contrary evidence for the generalization, we do not know why large amounts of guidance are less effective for learning. Wang (22) states that "any excessive amount of guidance is apt to develop either an attitude of overconfidence or a habit of dependence. Overconfidence leads to carelessness and many unnecessary errors are made and more and more trials are required for their elimination." He does not suggest why guidance brings about these attitudinal characteristics.

The above studies are quite enlightening, as far as they go, but they result in merely empirical observational statements about the influence of guidance upon learning. No real attempts are made to explain the function of guidance and its varied enhancing and deleterious effects on learning. Surely something more specific is needed to explain the influence of guidance on learning.

Another generalization to be found in the literature indicates

that too little guidance has little, if any, beneficial effect upon learning. In support of this, Alonzo (1) reports his finding from an experiment concerned with guiding the rat through the maze on a leash. He states that a small amount of initial guidance was detrimental to the learning. Using a demonstration method in a bead-drawing, ideational learning problem, Waters (24) reports that this method was detrimental to learning. He comes as close to an explanation as his data will permit when he notes that the demonstration method may be detrimental "due to the fact that the subject develops a feeling of dependence upon the demonstration which gives him a clue to the first draw . . . and not the subsequent draws, he is not materially helped." Both Alonzo (1) and Ludgate (14) concluded from their experiments that small amounts of guidance when given initially were detrimental to learning, but when given later, yet still early in the learning, proved efficacious. In comparing Ludgate's results, using manual guidance, with the results of his study using verbal guidance, Wang (22) reports that two trials of manual guidance was most effective, while four trials of verbal guidance proved most effective. In regard to intellectual problems, Corman (6) suggests that if little information is given the person may fail to solve the problem, while if large amounts are given the necessity for search, for possible alternative solutions, is lessened and the opportunity for a thorough examination of the problem is missed. This leads to a poor performance on the transfer problem. In his conclusion he indicates that the

effectiveness of guidance does not depend solely upon the amount of information given, but that more explicit information will prove most helpful with the more mentally able students while less explicit information may be just as effective for the mentally less able students.

In general these studies suggest that amount of guidance may be an essential variable in guided learning, but they imply more strongly that it is not so much the quantity of guidance as it is the time during the learning process when the guidance is inserted and the degree to which the guidance directs the learner to that which is to be learned that is important.

This leads to a third generalization that resulted from the early studies of guidance and learning which indicates that the effectiveness of guidance, in general, tends to increase the earlier in the learning process it is inserted. Carr (4) reports in his study of "the influence of visual guidance in maze learning" that "the earlier the introduction of vision, the greater is its effect upon total error score." According to his later article (5) mechanical guidance proved more effective when inserted early in the learning for both rats and human subjects. A given amount of verbal guidance, in the form of error information, is also reportedly more effective when given early in the learning. On the basis of his investigation of manual guidance, Alonzo (1) reports that "the effectiveness of a given amount of guidance varies with the position at which it is introduced." Haslerud (9) also reports that "our

results show guidance effective only during the formation of expectations concerning goal organization. . . ." He later questions the real value of guidance altogether (10) when no differences were found between guided and non-guided rats in breaking fixated habit responses. He suggests instead that "conditions favorable for learning" may be of major importance and that guidance, per se, may serve a subservient role in the learning. Carrying the guidance beyond the "initial" into the "adjusted" portions of learning, Haslerud concluded that mechanical guidance "leads to expectations of behavioral support with the consequent frustration when the support is removed" in the transfer problem. He suggests that "too much guidance will either build up interferences to subsequent learning or at best represent just so many wasted trials." Here again we are left in a quandary as to the nature of the interference. The implication is that it is solely the position in the learning process when the guidance is introduced which is the major factor. That is, how much is not as important as is when this amount of guidance is given. It is also evident that the "expectations of behavioral support" are the expressions of dependency by the subjects upon the guidance given. We would still ask, What is the effect of becoming dependent upon the guidance cues? Why does guidance interfere in the transfer situation?

It is our position that guidance, in order to be effective for learning, must point out or direct the subject's attention to

the cues necessary for the learning of a problem. Guidance must serve, in some way, to permit and/or promote the retention of the required elements of the problem. Under these conditions the subject will make use of, but not depend upon the guidance given so that subsequent learning without guidance will require a relatively simple adjustment.

Guidance which serves to distract the learner from the essentials of the problem will tend to engender within the subject a dependency upon the guidance cues. Thus, this subject might not learn the essential cues by which the problem can be mastered.

Hypotheses

The essential cues for learning a stylus maze such as the one employed in our experiment, are tactual and kinesthetic. Through this avenue of sensory experience the subject must determine the correct turns at the appropriate times in a goal-oriented direction. At each choice-point, cues related to a left or right turn and a forward or backward direction must be differentiated for errors to be eliminated. If guidance is given immediately upon making a choice, this guidance should interfere with the learning of the essential cues, and develop a dependency, on the subject's part, upon the guidance cues. This follows from the assumption that the learner must be aware of, or attend to, the elements of the problem situation, not to cues extrinsic to the problem, in order for correct responses to be executed. If, however, guidance, in the form of information, is given after the choice has been made, this should

assist the learner in determining the correctness or incorrectness of the kinesthetic experiences he has just received. This results from the fact that the subject has been exposed, without interference, to the cues intrinsic to the determination of correctness or incorrectness of his experiences. This rapid reality testing procedure promotes the retention or elimination of the choice response.

It also follows that in a transfer learning situation, in which guidance is absent, learning should proceed more efficiently for those who have experienced the tuition which directed them more directly to the important elements of the problem than for those who have not really grasped the essentials of the problem. On this rationale, the following testable hypotheses may be formulated:

<u>Hypothesis I</u>: On the training maze the group receiving delayed guidance (Group D), will perform most efficiently, followed by the group receiving immediate guidance (Group I) and the group receiving no guidance (Group C), respectively.

<u>Hypothesis II</u>: The group receiving delayed guidance (D) will learn the transfer maze habit most efficiently, followed by Group C and Group I, respectively.

<u>Hypothesis III</u>: Groups receiving small amounts of guidance (Group I-5 and Group D-5) will perform both maze problems more efficiently than groups receiving larger amounts of guidance (Group I and Group D).

<u>Hypothesis IV</u>: Subjects experiencing both forms of guidance

in the training period (Groups VI and VII) will report a preference for delayed over immediate guidance.

CHAPTER II

EXPERIMENTAL DESIGN

Subjects

A total of 202 University of Florida students served as subjects in this experiment. All subjects were enrolled during the 1957 summer session. Of this number 22 failed to reach the criterion in the transfer learning situation, leaving 180 who completed the experiment. Of these, 77 were women ranging in age from 17 to 49 years, with a mean age of 23.4 years. The 103 men subjects ranged in age from 18 to 54, with a mean age of 24.2 years. The students were permitted to serve only if they had not taken a course in experimental psychology and had had no prior experience in stylus maze learning. Thus, all subjects were naive regarding the nature of the experiment.

No other selective measure was used. Other factors, such as intelligence, emotional stability, previous experiences, and socio-economic background which might have conceivably influenced the individual's maze performance were assumed to be randomized throughout the total sample.

Apparatus

The training maze.--A ten-turn Warden-U (23) stylus maze was used. The maze was constructed from a piece of one quarter

inch plywood 10 1/4" x 11 1/4", cut according to Warden's dimensions. It was firmly set on a base by four holes in the pattern board fitting on four dowels in the corners of the base. Embedded into the smooth floor of the base were pieces of metal connected to four main terminals on one side of the base. The top surface of these metal plates, level with the floor of the maze, were as long as the width of the maze alleys and approximately one quarter of an inch wide. Four plates were used for each section of the maze, one on either side of each choice-point and one at the point in each alley just before the turn in the maze pathway. (See Figure 1).

Signal lights.--A six-volt dry cell battery powered a circuit from the terminals, through red and green signal lights, placed to the left of the apparatus enclosure, and to a metal-tipped stylus. Thus, the lights would be flashed when the stylus came into contact with the metal plate in the alley of the maze.

Shield.--A wooden frame covered on three sides with black crocus cloth concealed the maze from the subject's view. The open side faced the experimenter and permitted him to observe the subject's maze behavior. On the subject's side of the enclosure the crocus cloth permitted free movement of the hand while running the maze. (See Figure 2).

Transfer maze.--This maze was a lateral reversal of the training maze pattern. It rested on a smooth Masonite base and was held securely by the four corner pegs set in the base. There were no signal lights connected to this maze.

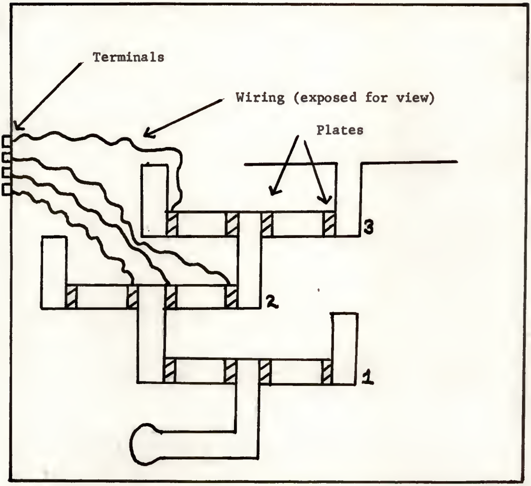

Fig. 1.--Top View of Maze Showing Placement of Metal Plates

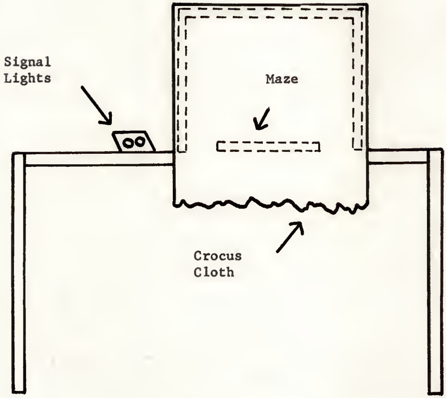

Fig. 2.--Apparatus (as viewed from subject's side)

Experimental Procedure

Practice.--As the subjects, individually, arrived at the experimental room they were assigned in order to one of seven groups to be called I, D, C, I-5, D-5, VI, and VII.

Group I received guidance immediately, at each choice-point, for all fifteen training trials. Guidance was given in this manner: The signal lights connected to the two plates located at the choice-points would flash if the subject moved in either direction. If the choice led into a blind alley the red light would flash, but if the choice was correct, leading to the next section of the maze, the green light would flash.

Group D, similarly, received guidance for each choice made, for all fifteen training trials. However, their guidance was delayed, i.e., the signal lights did not flash until the stylus was moved down the alley to a point just prior to the next turn in the maze pathway.

Group C was the control group. It received no guidance during the entire fifteen training trials.

Group I-5 received immediate guidance for the first five training trials, but none for the remaining ten trials, while Group D-5 received delayed guidance for the first five trials and none for the remainder of training.

Group VI received guidance for the twenty training trials in the following order: five trials - immediate guidance; ten trials -

delayed guidance; and then five more trials of immediate guidance. A counter-balanced order of presentation of guidance was used for Group VII, namely five trials - delayed guidance; ten trials - immediate guidance; and then five trials - delayed guidance.

Thirty subjects were arbitrarily assigned to each of Groups I, D, C, I-5, and D-5, and fifteen subjects were assigned to Groups VI and VII, respectively.

When the subject was seated in front of the apparatus the following instructions were given orally:

> You are going to learn to run a maze. A typical maze path is pictured on this card. (See Figure 3.) You will notice if you go in one direction it leads to a blind alley, therefore, the opposite direction would be the correct one leading to the next choice-point. Use the hand you ordinarily write with to guide the stylus, or pencil-like object, through the maze, from the beginning circle to the end circle, without making errors, that is, without going into blind alleys. Any questions?

In addition, subjects in Groups I and D were given the following instructions:

> We are going to help you to learn the maze. You see the lights on your left; the green light will light when you are on the true path to the goal and the red light will light when you have chosen a wrong path.

Groups I-5 and D-5 were told that they would have the help of the lights only part of the time while learning the maze and they were informed when the lights were disconnected.

In addition to the first set of instructions above, Groups VI and VII were given the following instructions:

> We are going to help you to learn the maze by giving you two kinds of information. Part of the time while you are

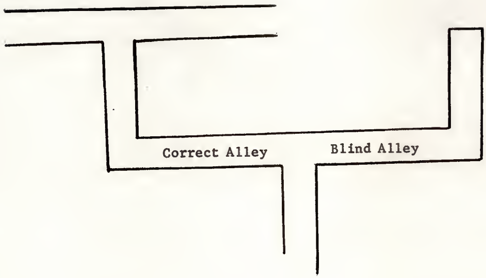

Fig. 3.--Sample Maze Path Shown to Subjects

> learning the maze the red light will go on immediately as you make the turn into a blind alley or the green light will go on as you make the correct turn toward the goal. And, part of the time, the lights will go on sometime after you have made the turn, red for incorrect, green for correct. When we are finished I would like to know which kind of information you felt helped more in learning the maze.

The subject then put his preferred hand under the black cloth and was given the stylus which was then placed in the beginning circle of the maze. All subjects in Groups I, D, C, I-5, and D-5 were given fifteen training trials, even if they mastered the maze prior to the fifteenth trial. A five- to fifteen-second period of rest was allowed between each trial. Subjects in Groups VI and VII were given twenty training trials.

Transfer.--Upon completion of 15 trials by Groups I, D, C, I-5, and D-5 and of 20 trials by Groups VI and VII, the subjects were given several minutes rest while the transfer maze was put in place. They were then instructed as follows:

> You are now going to learn another maze which is similar to the first one, but it has a different pattern. This time you will run it without any help from the lights. (This sentence was omitted for Group C.) You will continue to run this maze until you go through it once without error, i.e., without entering any of the blind alleys.

Retracing with the stylus was blocked with a pencil in both the training and transfer situations.

Criterion.--One errorless run on the transfer maze was required. As noted earlier, twenty-two subjects, 2 from Group I, 3 from Group D, 2 from Group C, 4 from Group I-5, 7 from Group D-5, 1 from Group VI, and 3 from Group VII, did not reach the criterion for several reasons. Some became emotionally upset at their lack of progress. Others felt

they could not spare the time necessary to finish. Still others were stopped because of time limitations by the experimentar. (All subjects were permitted at least one hour to complete the experiment.) Further discussion of the subjects who failed will be found in the next chapter.

(When one gives an arbitrary number of training trials, rather than a criterion, such as one errorless run, as we have done, he is exposed to the possibility that some subjects may make one or more errorlass runs during the training series. The problem will then arise as to whether the additional training to fifteen trials makes the groups unequal in the transfer situation. The altarnative is equally undesirable, however. Setting a criterion might introduce a variable amount of training which also makes the groups unequal in the transfer problem.)

Inquiry.--The subjects in Groups VI and VII were asked for their evaluation of tha relative benefit derived from the two methods of guidance in learning the training maze.

Records.--A record of the subject's errors for each of the tan units of the maze in the training and transfer situations was kept. Each unit was numbered (See Figure 1) to aid in recording the arrors. An error was counted when the red light was lighted and when the subject progressed more than one-fourth of the blind alley. (Some subjects unintentionally slipped into blind allays as a result of pressure against tha alley wall and generally turned in the correct direction before traversing one-quarter of the length

of the blind alley. This behavior was not counted as an error.) This record of errors permitted the summing for total errors per trial, as well as, the number of errors per choice-point.

From the design of this study, the immediate-guided subjects would be expected to spend less time than the delayed-guided subjects in the training maze because they need not penetrate as deeply into the maze alleys before receiving the guidance cues. This may also be expected to affect performance in the transfer learning situation. The employment of a time criterion is thus not a valid measure of the effect of guidance itself. Therefore, time will not be considered further in the results of this study. The total time for each subject is available, however, in the Appendix of this paper.

CHAPTER III

TREATMENT OF THE RESULTS

The design of the experiment included the analysis of variance of errors during training and of errors and trials to criterion in the transfer situation.

The first step in the analysis of the data was that of determining the homogeneity of variance of the learning records for Groups I, D, C, I-5, and D-5, all of whom received the same treatment except for the type and amount of guidance administered. For this purpose Cochran's test (8) was employed. The results shown in Table 1 indicate that, for errors on the training problem, the resulting value was .3556. This implies that a larger value of the function would be expected to occur by chance less than once out of one hundred replications. This means that we can safely accept homogeneity of variance among the groups for this measurement. Table 1 also shows that homogeneity is acceptable for errors in the transfer situation, but that we cannot assume homogeneity for trials to criterion.

Where homogeneity of variance was verified by the results of the Cochran test the next step consisted of an analysis of variance. This was done to determine the over-all influence of the variable, guidance, on the variances between groups. The analysis of variance of the training-errors data is presented in Table 2. The highly

TABLE 1

HOMOGENEITY OF VARIANCE

	Training	P	Transfer	P
Errors	.3556	$<.01$	.3700	$<.01$
Trials to Criterion			.7332*	$>.05$

*Reciprocal transformation of the data.

TABLE 2

ANALYSIS OF VARIANCE OF TRAINING - ERRORS DATA

Source	Sum of Squares	df	Variance Estimate	F	P
Between	9,172.20	4	2,293.05	7.71	$<.001$
Within	43,135.13	145	297.48		
Total	52,307.33	149			

significant F indicates that the between group variance was beyond chance expectancy (as a result of the guidance). The analysis of variance of the transfer-errors data is presented in Table 3. The resultant F was not significant beyond the 5 per cent level of probability. We can conclude that between group variance on the transfer error measurement was not appreciably influenced by the training

TABLE 3

ANALYSIS OF VARIANCE OF TRANSFER - ERRORS DATA

Source	Sum of Squares	df	Variance Estimate	F	P
Between	19,046.36	4	4,761.59	1.26	$>.05$
Within	547,325.80	145	3,774.66		
Total	566,372.16	149			

procedure. An analysis of variance of the trials to criterion data was not permissible as a result of the inhomogeneity of variance, even after a reciprocal transformation of the data.

The usual _t_ test was then used to determine the significance of differences between group means. Reported _t's_ are based on 58 degrees of freedom. A minimum of 5 per cent probability was considered as indicating statistical significance.

Training.--The means and standard deviations of the errors on the training maze are reported in Table 4. The _t's_ were computed for the differences between all group means. Those significant are the differences between means in Group I and D resulting in a _t_ of 2.86, which is significant at the 0.01 level; between means in Group I and C the _t_ was 2.48, which is significant at the 0.05 level; between means in Group D and C the _t_ was 5.85, which is significant at the 0.001 level; between means in Group D and D-5 the _t_ was 3.94, which is significant at the 0.001 level; and between means in Group D and I-5 the _t_ was 4.21, which is significant at the 0.001 level.

TABLE 4

MEANS AND STANDARD DEVIATIONS OF TRAINING MAZE PERFORMANCE

Group	Errors	
	Mean	Standard Deviation
I	50.67	17.59
D	38.57	15.04
C	61.07	14.77
I-5	56.93	18.51
D-5	56.43	19.75

Hypothesis I, that Group D will perform most efficiently followed by Group I and Group C, respectively, in the training maze, is supported by the above data. Group D made significantly fewer errors than Group I, and Group I made significantly fewer errors than Group C. Delayed guidance yielded the greatest benefit, followed by immediate guidance and no guidance, respectively.

Fifty-five of the one hundred and fifty subjects made one or more errorless runs during the 15 training trials. Of these, 15 subjects were in Group I, 22 in Group D, 4 in Group C, and 7 each in Group I-5 and D-5. It was important to ascertain if the numbers in the various groups deviated significantly from chance expectancy in view of the different forms of guidance they received. The chi-square contingency method (19), corrected for continuity and

with 1 degree of freedom, was applied to all group differences. The significant chi-squares found were: between Group I and D a chi-square of 4.51, which is significant at the 0.05 level; between Group I and C the chi-square of 7.70, which is significant at the 0.01 level; between Group D and D-5 and Group D and I-5 the chi-squares of 15.76, which are significant at the 0.001 level. Further support for the acceptance of Hypothesis I is seen in the significantly greater number of subjects to make errorless runs in Group D when compared with Group I and the significantly greater number of subjects in Group I than in Group C to make errorless runs.

Hypothesis III, which predicts greater benefit from small amounts of guidance, must be rejected. Groups I-5 and D-5, receiving small amounts (five trials) of immediate and delayed guidance, respectively, made significantly more errors than Group D and slightly more errors than Group I.

Transfer.--The means and standard deviations of the errors and trials to criterion are reported in Table 5. The significant difference between means of the errors is between Group D and C which resulted in a t of 2.15, which is significant at the 0.05 level. All other computed t's were not significant. Group D made significantly fewer errors than Group C. The superiority of delayed guidance in a subsequently similar, but different learning situation over no guidance is evident. The training period with immediate guidance appears almost equally as profitable as no guidance at all.

TABLE 5

MEANS AND STANDARD DEVIATIONS OF TRANSFER MAZE PERFORMANCE

Group	Errors		Trials to Criterion	
	Mean	Standard Deviation	Mean	Standard Deviation
I	80.20	60.25	24.07	17.24
D	53.60	49.49	17.30	13.84
C	83.63	58.34	25.80	15.67
I-5	82.73	71.39	26.13	21.06
D-5	70.63	65.51	22.77	18.64

The single significant _t_ for the trials to criterion measure was a _t_ of 2.22 between the means in Group D and C, which is significant at the 0.05 level. It can be said that Group D learned the transfer maze most efficiently of all the groups. Hypothesis II predicted that Group D would learn the transfer maze most efficiently, but it also stated that Group C and I would follow respectively in performance. Therefore, Hypothesis II must in part be rejected on the basis of this evidence, because of the fact that the differences between means, on both transfer measures, for Groups I and C are not significant. The trend, as evidenced by the magnitude of means in Table 5, would seem to imply that Group I learned slightly more efficiently than Group C.

In further confirmation of the above rejection of Hypothesis III, the results in Table 5 on the performance of Groups I-5 and D-5

as compared with Group I and D were somewhat inferior for both measures. At no time, in our study, did small amounts of either form of guidance, as represented by Groups I-5 and D-5, prove significantly more effective for learning the maze habit than either form of large amounts of guidance, represented by Groups I and D.

As reported in Chapter II, twenty-two of the original subjects who started the experiment had to be dropped because they failed to reach the criterion on the transfer maze. That they were relatively evenly distributed in the seven groups implies that the form of guidance was not an overly influential factor resulting in their elimination.

Inquiry.--It will be recalled (See page 14) that Group VI received five initial training trials of immediate guidance, followed by ten trials of delayed guidance, and then five final trials of immediate guidance. Group VII received a counter-balanced order of presentation of the two forms of guidance, in an attempt to control for the possibly biasing influence of the guidance introduced initially. In addition to the quantitative differences in the two modes of guidance reported above, we were interested in the impressions and evaluations of the subjects in these groups regarding the effectiveness of the two forms of guidance.

Forty-seven per cent preferred delayed guidance, while thirty-seven per cent indicated a preference for immediate guidance, and sixteen per cent did not feel that either method was superior in

helping them to learn the maze. The performance of the two groups, in respect to all measures on the training and transfer mazes, did not differ to any statistically significant extent. This evidence does not prove Hypothesis IV, which predicts a greater preference for delayed guidance over immediate guidance, but it does lend support to our supposition. The following verbatim remarks may help to clarify the thinking behind the evaluations of these subjects.

Subjects who indicated a preference for the immediate information made such comments as:

> The immediate information was better because I didn't have to back up, which made me forget what my process was.
>
> Immediate information was more helpful as a signal, but delayed tends to make you rely more on your own memory rather than the signal.
>
> Most helpful were the immediate lights because the error could be corrected immediately.
>
> Immediate was more helpful because it permitted a quicker change.

Those who expressed a preference for delayed guidance made such remarks as the following:

> Delayed was more helpful because you benefit more by trial and error than getting information immediately.
>
> Delayed more helpful because you think more and going back permits you to remember.
>
> Delayed information was more helpful because immediate caused me to startle and forget my error, while delayed gave me time to know the correct turns.

Discussion of the Results

The results strongly suggest that delayed guidance is more efficacious than immediate guidance for maze learning. We are able to accept Hypothesis I because, in the training situation, Group D proved superior to Group I and Group I superior to Group C. In addition to this, significantly more subjects in Group D achieved one or more errorless runs during the training than did subjects in Group I and significantly more in Group I than in Group C.

In the transfer situation Group D, again, proved most efficient. Since Group C did not prove superior to Group I we must reject part of Hypothesis II.

There was no indication that small amounts of guidance, as operating in this experiment, were ever more beneficial than either method of large amounts of guidance. Therefore, Hypothesis III must be rejected.

Although there was a greater preference for delayed over immediate guidance by subjects receiving both forms, we cannot confidently accept Hypothesis IV because the difference between the proportion of subjects who stated their preference is not statistically reliable.

How does guidance operate to enhance learning? What explanatory principle, if any, have we uncovered as a result of this experiment? Unfortunately, these questions are not so easily answered, nor did we really anticipate being capable of entirely answering the first on the basis of this study. We would like to

conclude that delayed guidance tends to point out more effectively the tactual-kinesthetic cues the subject is required to learn in order to master the maze, but the evidence does not permit this general conclusion. We actually do not know <u>why</u> delayed guidance is more beneficial than immediate guidance. Possible clues to the differential influence of the two methods of guidance may be found in the reports of the subjects. Delayed guidance may be more beneficial because it requires the subject to "think more," to "rely more on [his] own memory," or it gives the subject "more time to know the correct turns." These subjective statements suggest the inference that delayed guidance permits or requires greater or fuller participation by the subject in the learning. Immediate guidance serves more as a mere "signal" promoting greater dependency on the guidance and passive learning on the part of the subject. There are, of course, pure speculation, but then from this future research may develop.

Our results lead to the notion that guidance operates differently for humans than for infra-human organisms. Haslerud's (9) conclusion that "guidance is effective only during the formation of expectations concerning goal organization. . . ." is not supported by our results. It may well be that for rats, using mechanical guidance his conclusion will hold and, likewise, Maier's (15) contention, that guidance is effective for breaking old habits and not in enhancing new learning, is valid using his method and with that single specie. Certainly guidance, in the form of information,

serves not only to establish initial goal oriented behavior, but thereafter tends to promote the effective maze habits. Our results support Wang's (22) finding which was that of three forms of verbal guidance he used, "Method C" (the naming of the type of error after it was made) proved most effective. It may be that learning retrospectively complies with man's conceptual capacities while the more immediate, mechanical means of guidance fall more in the range of the rat's capabilities.

CHAPTER IV

SUMMARY AND CONCLUSIONS

The purpose of this study was to investigate the relative influence of immedate and delayed guidance, in the form of information, and of different amounts of guidance on human learning and transfer. The investigation was originally stimulated by the results of a recently completed doctoral study which caused several questions to be asked. What is the effect of dependency upon guidance on learning? How or when does guidance facilitate learning? In general, the experimental studies of guidance and learning yield only generalizations regarding the influence of guidance on learning. Statements such as: large amounts of guidance are detrimental to learning, too little guidance has little, if any, beneficial effects upon learning, and guidance given early in the learning process tends to be most efficacious, are merely empirical observations and do not lead to an explanation of the role guidance plays in learning. Our intention, thus, was to seek out explanatory principles for these generalizations. In so doing we assumed that guidance given at critical times during learning may serve to interfere with the acquisition of the essential elements to be learned. While guidance given some time after these crucial points might more ably facilitate the differentiation and retention of the cues necessary for the learning. It was also felt that the

influences of the methods would extend over into a transfer learning situation in which no guidance was given. If these assumptions are valid, it should follow that: (1) in the training situation delayed guidance should prove most influential followed by immediate and no guidance, respectively; (2) in the transfer situation delayed guidance should prove most beneficial followed by no guidance and immediate guidance, respectively; (3) small amounts of guidance will enhance learning more than large amounts of guidance in both situations; and (4) subjects experiencing equal amounts of both forms of guidance will express a preference for delayed guidance.

One hundred and eighty college students, male and female, with an average age of 24 years, and naive as to maze learning completed the experiment. As each subject arrived he or she was assigned at random to one of seven groups, known as Groups I, D, C, I-5, D-5, VI, and VII. Subjects were seated before a black crocus cloth-covered frame in which the ten-turn Warden U-type maze was situated. They were given a sample picture of one unit of the maze, and told to try to learn the maze pattern by repeatedly moving a stylus from beginning to end. Metal plates embedded in the floor of the maze as specific points served to mechanically operate red and green signal lights when the subject touched them with the stylus. Subjects in Groups I and D were told to watch the lights as they would light to indicate the correctness or incorrectness of their turns. The lights for Group I operated just as the subject made his turn at each choice-point in the maze and for Group D they

operated sometime after the choice was made; red indicated an incorrect turn and green a correct turn. Fifteen trials with guidance served as the training period. No guidance was given to Group C and only five trials of immediate guidance was given to Group I-5 and five trials of delayed guidance to Group D-5, although they all received fifteen training trials. Groups VI and VII received five, ten, and five trials of delayed, immediate, and delayed guidance, respectively, in a counterbalanced order. They were further asked to evaluate the two methods of guidance. Following a brief rest after completing the practice trials, the lateral reversal of that maze was used in the transfer learning situation. No lights were connected to this maze and all subjects were instructed that they would operate the stylus until they had completed one errorless trial. Errors and time were recorded, but due to an artifact in the design of the experiment time was not considered in the treatment of the results.

The analysis of variance indicated a significant between group variability of errors during training. This was the result of the different modes and amounts of guidance given. Hypothesis I was confirmed on the basis of the significantly superior performance of Group D over Group I and Group I over Group C on the training maze. In addition, significantly more subjects in Group D than in Group I made one errorless run during training, and significantly more subjects in Group I than in Group C did the same. Although Group D performed more efficiently on the transfer maze than Group C,

Hypothesis II had to be partly rejected because the means for Group I and Group C did not differ appreciably for both measures of errors and trials to criterion. Hypothesis III had to be completely rejected because small amounts of guidance, as given to Groups I-5 and D-5 never demonstrated superior performance to Groups I and D, which received large amounts of guidance. The reports of the subjects in Groups VI and VII indicated a greater preference for delayed guidance over immediate guidance, but not to any large extent, so Hypothesis IV could not be accepted.

Although delayed guidance proved more efficacious than immediate guidance, this does not permit us to say how it operated in the learning situation to enhance learning. Human learning, even maze learning, is too complex and too variable to permit any easy generalization to infra-human behavior or vice versa. Our results do not agree with the conception of guidance as enhancing only anticipative goal oriented behavior, but it is speculated that guidance, in the form of information, may serve man's retrospective conceptual powers.

Research possibilities.--Additional analytic studies of the role of guidance and learning are necessary before significant theoretical formulation may be attempted. In the light of our findings it would be interesting to utilize our initial supposition regarding immediate and delayed guidance in a study of ideational learning or learning more complex reasoning problems. This might more sharply distinguish the apparent enhancing qualities of delayed guidance from the suspected supportive characteristics of immediate

guidance. Repeating Corman's (6) study employing these guidance methods might further clarify the learner's role in how and when the guidance is used in his learning.

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APPENDIX

TABLE 6

GROUP I - RAW DATA

Subject	Age	Sex	Training		Transfer		
			Total Time (sec.)	Total Errors	Total Time (sec.)	Total Errors	Trials to Criterion
1	18	M	587	32	621	57	26
2	25	M	1133	31	545	8	6
3	20	F	652	62	419	32	8
4	31	M	542	48	657	56	16
5	18	F	546	42	374	27	8
6	24	M	531	23	232	9	3
7	18	F	459	47	1548	215	56
8	20	M	530	72	723	60	17
9	17	F	591	40	470	35	11
10	18	F	486	56	324	45	14
11	31	M	598	47	1582	145	41
12	32	M	595	78	1817	165	46
13	20	F	653	60	1370	123	40
14	20	F	673	67	572	89	21
15	18	M	342	78	1275	171	52
16	37	F	717	52	2688	173	61
17	25	F	893	53	1452	125	36
18	25	F	446	42	1673	124	42
19	23	M	496	66	1535	181	43
20	25	F	517	40	617	76	20
21	25	M	760	63	1927	82	30
22	31	M	486	60	627	91	28
23	20	M	462	23	203	14	4
24	22	M	671	26	431	14	5
25	20	M	549	90	1031	119	33
26	20	M	314	64	369	37	10
27	27	M	440	27	538	43	12
28	24	F	1169	51	1192	60	21
29	22	M	1047	51	325	10	4
30	26	F	1132	29	795	20	8

TABLE 7

GROUP D - RAW DATA

Subject	Age	Sex	Training Total Time (sec.)	Training Total Errors	Transfer Total Time (sec.)	Transfer Total Errors	Trials to Criterion
1	27	M	688	41	638	37	15
2	20	F	647	37	1156	137	38
3	18	M	864	37	399	31	12
4	26	M	743	22	482	39	15
5	17	F	1017	33	640	45	12
6	38	M	659	56	1012	76	22
7	25	F	697	29	427	17	6
8	25	M	767	36	485	28	10
9	23	M	547	55	210	21	6
10	20	M	294	21	331	35	9
11	21	M	384	15	274	15	5
12	19	F	591	32	395	22	9
13	48	F	714	51	559	36	14
14	22	F	490	25	811	71	25
15	26	F	1124	62	2316	171	50
16	19	F	687	20	160	9	3
17	54	M	657	49	1439	125	34
18	25	F	774	56	730	65	25
19	23	M	662	59	538	32	14
20	20	F	610	28	229	19	8
21	24	M	821	46	368	24	8
22	40	M	561	25	340	21	11
23	19	F	536	42	279	27	10
24	21	M	610	34	439	54	14
25	18	F	681	24	917	54	21
26	20	F	552	69	1092	220	64
27	22	M	689	41	743	70	21
28	25	M	753	18	344	16	5
29	20	M	757	63	905	70	24
30	19	F	581	31	328	21	9

TABLE 8

GROUP C - RAW DATA

Subject	Age	Sex	Training Total Time (sec.)	Training Total Errors	Transfer Total Time (sec.)	Transfer Total Errors	Trials to Criterion
1	23	F	1213	77	1145	163	39
2	18	F	644	65	784	161	53
3	23	F	982	69	619	55	19
4	20	F	2497	70	2599	227	51
5	27	M	1028	46	108	4	4
6	19	M	1109	46	448	28	12
7	25	M	526	60	860	85	28
8	24	M	587	72	1289	172	51
9	19	M	442	57	764	82	32
10	22	M	882	63	1004	52	20
11	19	F	480	66	610	89	32
12	19	F	627	82	185	17	6
13	21	M	681	76	457	62	15
14	25	M	483	17	29	0	1
15	20	F	1080	68	1352	91	33
16	20	M	1321	27	215	6	2
17	19	F	487	67	550	52	20
18	46	F	764	63	1446	111	34
19	18	M	829	49	1214	91	23
20	20	F	741	70	257	34	10
21	32	F	940	56	549	35	11
22	54	M	1060	42	981	52	20
23	23	M	566	73	910	90	29
24	24	M	551	52	1054	148	49
25	28	M	571	53	675	62	18
26	28	F	614	79	950	171	47
27	24	M	762	74	1512	148	42
28	22	F	574	64	288	25	11
29	26	M	755	68	1552	119	40
30	28	M	647	61	706	77	22

TABLE 9

GROUP I-5 - RAW DATA

Subject	Age	Sex	Total Time (sec.)	Total Errors	Total Time (sec.)	Total Errors	Trials to Criterion
1	24	F	1239	73	2794	262	81
2	20	F	1048	75	455	42	13
3	21	M	1163	61	578	41	13
4	21	M	616	52	1274	122	45
5	21	F	748	101	899	198	63
6	26	M	714	61	2362	265	73
7	18	F	1137	63	291	19	10
8	21	M	708	61	847	54	21
9	19	M	386	16	219	8	3
10	21	F	1095	40	463	25	6
11	22	F	1481	49	1407	78	23
12	49	F	894	76	1373	93	34
13	19	F	811	59	358	46	12
14	30	M	1212	78	580	59	20
15	20	F	740	80	1198	129	44
16	24	M	1419	32	1062	40	11
17	24	M	711	62	529	37	15
18	18	M	823	70	774	66	21
19	24	M	429	32	80	6	4
20	19	M	682	32	33	0	1
21	21	M	503	38	1657	186	54
22	25	M	440	42	220	18	10
23	30	M	320	62	374	105	27
24	18	M	497	55	962	110	44
25	23	M	1029	50	580	24	7
26	27	M	535	28	652	64	17
27	26	F	652	58	860	137	36
28	19	M	852	73	1480	143	38
29	22	M	640	66	745	75	26
30	28	F	573	63	254	30	12

TABLE 10

GROUP D-5 - RAW DATA

Subject	Age	Sex	Training Total Time (sec.)	Training Total Errors	Transfer Total Time (sec.)	Transfer Total Errors	Trials to Criterion
1	18	M	1049	39	431	25	12
2	17	F	1143	66	2300	267	76
3	28	M	905	73	753	41	13
4	26	M	429	60	856	119	41
5	25	M	477	32	90	7	3
6	23	M	592	33	1 73	8	4
7	22	F	777	77	2018	195	56
8	19	M	774	52	588	51	16
9	23	F	611	66	204	28	9
10	26	M	581	61	404	26	12
11	28	M	468	31	133	13	5
12	26	M	696	29	276	11	5
13	20	F	628	76	884	99	31
14	25	M	535	42	234	19	8
15	26	M	616	48	1662	179	54
16	19	M	508	45	208	34	10
17	29	F	1516	12	1168	29	11
18	19	F	665	65	884	72	25
19	22	F	416	63	713	114	31
20	18	M	751	61	593	70	24
21	20	M	716	39	323	22	13
22	22	F	1106	65	942	93	28
23	20	F	893	61	772	46	17
24	21	M	828	91	691	93	25
25	27	M	336	61	1426	176	58
26	20	M	777	75	923	25	13
27	31	F	801	80	784	88	29
28	20	F	554	88	664	128	38
29	19	F	557	28	193	12	4
30	20	F	713	74	473	29	12

TABLE 11

GROUP VI - RAW DATA*

Subject	Age	Sex	Training Total Time (sec.)	Training Total Errors	Transfer Total Time (sec.)	Transfer Total Errors	Trials to Criterion
1	20	M	691	62	314	42	16
2	21	F	695	48	571	71	23
3	24	M	656	94	1270	162	50
4	36	M	475	12	185	12	5
5	21	F	611	88	815	188	58
6	27	F	1932	45	1867	60	21
7	20	F	631	63	980	90	28
8	24	M	1841	13	318	6	3
9	27	M	657	58	627	66	20
10	28	M	992	67	554	37	11
11	19	M	972	61	801	70	27
12	20	F	1069	59	630	30	8
13	22	F	782	65	506	78	24
14	18	M	654	43	464	55	17
15	45	F	1563	126	1332	186	39
GROUP VII - RAW DATA*							
1	26	M	1171	58	912	70	24
2	19	M	825	66	907	136	42
3	19	F	638	69	371	64	21
4	18	F	895	28	702	29	9
5	23	F	830	74	1534	109	34
6	22	F	825	92	1115	111	32
7	24	M	437	114	283	49	18
8	28	F	619	65	520	2	3
9	22	M	508	89	320	39	12
10	17	M	734	30	244	20	6
11	32	M	724	36	346	27	10
12	23	M	427	12	242	18	8
13	25	M	500	73	320	37	11
14	18	M	711	30	267	29	7
15	47	F	943	80	541	56	16

*These groups received 20 training trials as compared with 15 trials for the other groups.

BIOGRAPHICAL DATA

The writer was born on August 5, 1926, in New York City. In 1944 he graduated from John Adams High School in Ozone Park, Long Island and entered the United States Navy soon after. From 1944 to 1946 he served with the Seabees in the Pacific theater of operations, and was honorably discharged with the rank of Machinist's Mate Third Class.

After completing necessary preparatory courses at Dwight Preparatory School in New York City he entered Hofstra College in September, 1947. In October, 1950 he earned the B. A. with a major in Psychology. He entered City College of New York and continued his work with the aid of a New York State School Psychologist scholarship. The Master of Arts degree in School Psychology was granted in June, 1952. Additional course work in projective techniques was done during the summer of 1952 at the New School for Social Research (New York).

From September, 1952 to September, 1953 he served as a psychology intern at the Elgin State Hospital, Elgin, Illinois. In September, 1953 he entered the University of Florida to further pursue his graduate studies in Psychology. From April, 1954 to August, 1956 he held the position of graduate assistant in the Reading Laboratory and Clinic. At present he is an Interim Instructor in the Reading Clinic. He is an Associate in the American Psychological Association, a member of the Southeastern Psychological Association, Florida Psychological Association and the American Association for the Advancement of Science.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of the committee. It was submitted to the Dean of the College of Arts and Sciences and to the Graduate Council and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

June 9, 1958

C. F. Byers

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